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Report of the 1992 Gordon Research Conference on Point Defects, Line Defects and Interfaces in Semiconductors

By any number of measures the 1992 Gordon Research Conference on Point Defects, Line Defects and Interfaces in Semiconductors was very successful. The Gordon conference organization evaluates all of its conferences by means of a questionnaire to all participants. Our conference was ranked 20 out of 134 conferences held during the summer of 1992. This is especially good for a field that is so mature.

Good choices of discussion leaders and speakers were key to this success. Speakers from related fields where new and important defect problems are emerging generated a lot of excitement. The 23 invited talks were presented in sessions run by 11 different discussion leaders. In addition 59 posters were presented. The total number of participants was about 125. In this year of reduced travel budgets, many key people would not have been able to participate without financial support. Having so many younger scientists among the participants was also important.

The conference finances are summarized on the attached sheet. Since no conference proceedings or abstract book was printed, I submit the final program along with a complete list of the poster presentations as the final report.

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Gordon Research Conference

Point Defects, Line Defects, and Interfaces in Semiconductors
Plymouth State College (South), Plymouth, NH USA
July 20-24, 1992

Chair: P.M. Mooney

Vice Chair: M. Stavola

Monday 8:45 am Interdiffusion at Heterointerfaces

Discussion leader: P.M. Petroff (UCSB)

- | | |
|---------------------|--|
| Q.-M. Zhang (NCSU) | "Theory of Impurity-Enhanced Interdiffusion in GaAs/AlAs Superlattices" |
| F.H. Baumann (AT&T) | "Interdiffusion in Highly Strained Semiconductor Systems: Effect of Strain, Composition and Fermi Level" |
| S.M. Prokes (NRL) | "Interdiffusion in SiGe/Si Superlattices" |

Monday 7:30 pm Rare Earth Impurities in Semiconductors

Discussion leader: J.M. Langer (Warsaw)

- | | |
|-------------------|---|
| B. Lambert (CNET) | "Excitation Mechanisms of Rare Earth (Yb,Er) in III-V Semiconductors (InP)" |
| J. Michel (MIT) | "Properties of Er Centers in Si" |

Tuesday 9:00 am Microscopic Structure of Point Defects

Discussion Leaders: J.-M. Spaeth (Paderborn)/G.A Baraff (AT&T)

- | | |
|-------------------------------------|---|
| G. Davies (London) | "Isotope Probes of Optical Centers" |
| G.D. Watkins (Lehigh U.) | "Structure Determination by Magnetic Resonance: Strengths and Weaknesses" |
| M.L.W. Thewalt
(Simon Fraser U.) | "Studies of EL2 using Photoluminescence and Related Techniques" |

Tuesday 7:30 pm Strain Relief in Lattice Mismatched Heterostructures

Discussion leader: F.K. LeGoues (IBM)

- | | |
|---------------------|--|
| R. Hull (AT&T) | "Misfit Dislocations Microstructures and Kinetics" |
| B.S. Meyerson (IBM) | "Preparation of Viable Type I and II SiGe/Si Heterojunctions: Strain Relaxation and Other Phenomena" |

Wednesday 9:00 am**Light Impurities in Semiconductors**

Discussion leader: B. Clerjaud (Paris)

- J. Wagner (Fraunhofer-IAF) "Raman Spectroscopy of Impurity Induced Local Vibrational Modes in III-V Semiconductors"
- J. Weber (MPI-Stuttgart) "Interaction of Hydrogen with Defects in Si"
- B. Bech Nielsen (Aarhus U.) "Microstructure and Electronic Properties of Hydrogen in Si"

Wednesday 7:30 pm**Wide Band Gap Semiconductors**

Discussion leader: H. Kukimoto (Tokyo)

- C.G. Van de Walle (Xerox) "Solubility, Defect Reactions, and Doping Limits in ZnSe"
- J.M. DePuydt (3M) "Role of Defects in II-VI Blue-Green Diode Lasers"

Thursday 8:45 am**Diffusion in Si**

Discussion leaders: A.F.W. Willoughby (Southampton)/S.T. Pantelides (IBM)

- P. Blochl (IBM) "First-Principles Calculations of Self-Diffusion Coefficients in Si"
- H. Zimmermann (Duke U.) "Interstitial-substitutional Diffusion and its Application in the Measurement of Vacancy and Self-interstitial Concentrations in Si"
- N.E.B. Cowern (Philips) "Resolution of the Atomic Diffusion Mechanism for B in Intrinsic Si"
- M.E. Law (U. Florida) "Engineering Models of Point Defects and Diffusion in Si"

Thursday 7:30 pm**After Banquet Address**

- J.A. Giordmaine (NEC) "Why Our Company is Doing More Basic Research"

Friday 8:45 am**Structure of Surfaces and Heterointerfaces**

Discussion leader: A. Ourmazd (AT&T)

- J.H. Stathis (IBM) "EPR Identification of Electrically Active Interface Defects in MOSFETs"
- D. Gammon (NRI) "Optical Studies of Interfacial Disorder in GaAs/AlAs Quantum Wells"
- M.D. Pashley (Philips) "Compensating Surface Defects - the Mechanism for Fermi-Level Pinning on n-type GaAs (001)"

POSTERS

Gordon Conference on Point Defects, Line Defects, and Interfaces
in Semiconductors

Plymouth State College, Plymouth, NH
July 20 - 24, 1992

Patricia Mooney, chair

Michael Stavola, vice-chair

DX and EL2

A.1 First principles calculations of the pressure dependence of
EL2

C. Ziegler, Universitat Berlin

A.2 The role of spin triplets in DX centers, EL2, and other two
electron states in semiconductors

T.N. Morgan, IBM

A.3 Ultrasonic regeneration of EL2 luminescence in GaAs

I.A. Buyanova, S.S. Ostapenko, M.K. Sheinkman, M. Murrikov,
Ukrainian Academy of Science

A.4 Arsenic Antisite-related defects in GaAs

K. Krambrock and J.-M. Spaeth, Universitat-GH Paderborn

A.5 EPR and ODMR of the Te donor in AlSb

M. Kunzer, W. Jost, U. Kaufmann and J. Schneider, Fraunhofer IAF

A.6 Lattice strain from DX centers and Persistent photocarriers
in Sn-doped and Si-doped GaAlAs

T.N. Theis, G.S. Cargill, A. Segmuller, and T.F. Kuech, IBM

A.7 Formation of a DX center in InP under hydrostatic pressure

J.A. Wolk, W. Walukiewicz, E.E. Haller, Berkeley

M.L.W. Thewalt, Simon Fraser University

A.8 The symmetry of the EL2 defect in the metastable state

P. Trautman and J.M. Baranowski, Polish Academy of Science

A.9 Nonexponential photocapacitance transients in AlGaAs

J. Farmer, University of Missouri

A.10 EL2, New thoughts

J.D. Chadi, NEC

Metastable Defects

- B.1 ODMR study of a metastable defect in Si:S
H. Sun, B. Ittermann, S.S. Ostapenko, W.A. Barry, and G.D. Watkins, Lehigh University
M. Singh, G. Davies, and E.C. Lightowlers, King's College London
- B.2 The sulphur-related luminescence systems in Si
M. Singh, G. Davies, and E.C. Lightowlers, King's College London
G.D. Watkins, Lehigh University
- B.3 Multiple Charge States of Substitutional Oxygen in GaAs
R. Jones, University of Exeter
S. Oberg, University of Lulea

Defects in III-V's

- C.1 The incorporation of Si in δ -doped layers in MBE GaAs
R.C. Newman, M.J. Ashwin, R. Addinall, M. Fahy, J.J. Harris, D. Sansom, D. McPhail and V.K.M. Sharma, Imperial College
- C.2 Heavily Si doped MBE GaAs grown at low temperatures
S.A. McQuaid and R.C. Newman, Imperial College
M. Missous and S. O Hagen, University of Manchester
- C.3 Electronic states of In interstitials in GaAs
J.T. Schick and C.G. Morgan, Villanova University
- C.4 Investigation of the stress dependence of the zinc acceptor ODMR in zinc-doped InP under uniaxial stress
H.C. Crookham, E.R. Glaser, R.L. Henry and T.A. Kennedy, NRL
- C.5 Photoluminescence microscopy investigation of lattice defects in heterostructures grown by MOVPE and MBE
Z.M. Wang, M. Baeumler, K. Bachem, E.C. Larkins, J.D. Ralston and W. Jantz, Fraunhofer IAF

Metal Impurities

- D.1 Electron spin resonance of titanium in 4H-SiC
K. Maier, J. Schneider, Fraunhofer IAF
G.D. Watkins, Lehigh University
- D.2 EPR of the $(\text{Ti})^-$ acceptor state in the pseudocubic site of 4H-SiC
P.M. Williams, V.S. Weiner, F.S. Ham, and G.D. Watkins, Lehigh University
K. Maier, J. Schneider, Fraunhofer IAF

Metal Impurities (cont.)

D.3 Optical study of the Fe-related transitions in GaP

K. Pressel, A. Dornen, G. Ruckert, Univ. Stuttgart

K. Thonke, Univ. Ulm

W. Ulrici, Paul Drude Institut

D.4 Luminescence of thulium in III-V semiconductors grown by MOVPE

A. Dornen, K. Pressel and C. Hiller, Universitat Stuttgart

D.5 High resolution photoluminescence studies on Si implanted with Er and N

W. Jantsch, H. Ruckser, Johannes Kepler Universitat

H. Przybylinska, Polish Academy of Sciences

D.6 The stress alignment of gold in Si

A.L. Thilderkvist, M. Kleverman, and H.G. Grimmeiss, University of Lund

G.D. Watkins, Lehigh University

D.7 EPR identification of the acceptor states of the trigonal iron-boron and iron-aluminum pairs in Si

W. Gehlhoff and K. Irmscher, AG EPR im

Wissenschaftler-Integrations-Programm

I. Rehse, Institut für Kristallzüchtung im Forschungsverbund Berlin e.V.

D.8 On the structure of lithium-induced gold and platinum defects in silicon

S. Greulich-Weber, P. Altheheld, J.-M. Spaeth, H. Overhof and M. Hohne, Universitat-GH Paderborn

D.9 Photoconductive properties of Er-related centers in InP

X.Z. Wang, A.J. Neuhalfer and B.W. Wessels, Northwestern Univ.

SiGe Alloys

E.1 Competition of lattice and partial dislocation glide as a function of growth orientation

E.P. Kvam, Purdue University

R. Hull, AT&T Bell Laboratories

E.2 Crystallographic tilting resulting from relaxation by the modified Frank-Read mechanism

F.K. LeGoues, P.M. Mooney, and J.O. Chu, IBM

E.3 Optical investigation of MBE grown strained SiGe layers and quantum wells

K. Thonke, J. Denzel, M. Wachter, U. Mantz, and R. Sauer
Universitat Ulm

E.Schaffler, H. Kibbel, H.J. Herzog, E. Kasper, Daimler Venz
Forschungszentrum

SiGe Alloys (cont.)

- E.4 SiGe/Si (100) MBE grown quantum wells: arguments for type II band alignment
K. Thonke, Universitat Ulm

Diffusion and Interdiffusion

- F.1 Modeling dopant diffusion and group III interdiffusion in III-V superlattices
E.L. Allen, San Jose State University
M.D. Deal and J.D. Plummer, Stanford University
V.K.F. Chia, Charles Evans and Associates
- F.2 Molecular dynamics investigation of point defects and diffusion in GaAs
C.G. Morgan and J.I. Landman, Wayne State University
- F.3 Recombination-enhanced diffusion of Be in GaAs
K. Wada, NTT
- F.4 Interdiffusion in the GaInAsP system
R.M. Cohen, University of Utah
- F.5 An elementary paradigm for non-equilibrium diffusion
R.F. Lever and F.F. Morehead, IBM
- F.6 Dopant and point-defect diffusion in Si thin films grown by MBE
H.-J. Gossmann, A.M. Vredenberg, C.S. Rafferty, F.C. Unterwald, H.S. Luftman, D.C. Jacobsen, and J.M. Poate, AT&T Bell Laboratories

Native Defects

- G.1 Radiative lifetimes and exchange vs. separation for Frenkel pairs in ZnSe
W.A. Barry and G.D. Watkins, Lehigh University
- G.2 Homogeneous and heterogeneous precipitation of self-interstitials in Si
M. Seibt, AT&T Bell Laboratories
- G.3 P_{In} antisites in low temperature gas-source MBE InP
W.M. Chen, P. Dreszer, K. Seendripu, E.R. Weber, UC Berkeley
B.W. Liang and C.W. Tu, UC San Diego
- G.4 Kinetics of annealing vacancies in diamond
G. Davies and A.T. Collins, King's College London

Native Defects (cont.)

G.5 Native defects in semiconducting In, Ga, and AlN
R.J. Egan and T.L. Tanlsey, Macquarie University

G.6 Metal-vacancy trapping by In donors in II-VI
semiconductors: a microscopic study by 111-In PAC spectroscopy
J.A. Gardner, J. Griffith, R. Lundquist, and R. Platzner, Oregon
State University

G.7 Thermally produced deep point defects in hexagonal SiC
polytype, V.S. Weiner, University of Chicago

Defects in Si

H.1 Deep level transient spectroscopy of NiSi₂-platelets and
of dislocations in Si
U. Gnauert, J. Kronewitz, M. Seibt, and W. Schroter, University
of Gottingen

H.2 Impurity decoration of defects in FZ and polycrystalline Si
via chemo-mechanical polishing
S. McHugo, UC Berkeley
W. Sawyer, Mobil Solar Energy Corporation

H.3 Photoluminescence measurements of a Be-related deep centre
in Si
M.H. Nazare, Universidade de Aveiro
M.O. Henry, Dublin City University

H.4 Interstitial ¹²B in p- and n-type Si after implantation
H.-P. Frank, T. Almeida, E. Diehl, K.-H. Ergezinger, B. Fischer,
B. Ittermann, F. Mai, W. Seelinger, S. Weißenmayer, G. Welker,
H. Ackermann, H.-J. Stockmann, Fachbereich Physik der
Philipps-Universität

H.5 Localized-pair recombination nature of visible luminescence
from anodized porous-Si
M. Mizuta, NEC

Hydrogen-related defects

I.1 EPR detection of a Pt-H₂ complex in Si
P.M. Williams and G.D. Watkins, Lehigh University

I.2 EPR study of hydrogen in Si
P. Stallinga, T. Gregorkiewicz and C.A.J. Ammerlaan, University
of Amsterdam
Yu.V. Gorelkinskii, Academy of Sciences of Kazakhstan

Hydrogen-related defects (cont.)

I.3 Hydrogen-acceptor pairing in CdTe epitaxial layers grown by OMVPE

B. Clerjaud and D. Cote, Universite Pierre et Marie Curie
L. Svob, Y. Marfaing, and R. Druilhe, Laboratoire de Physique
des Solides de Bellevue

I.4 Hydrogen-isoelectronic impurity complexes in III-V compounds

B. Clerjaud, D. Cote, W.-S. Hahn, C. Porte, D. Wasik, and W.
Wilkening, Universite Pierre et Marie Curie
W. Ulrici, Paul-Drude-Institut fur Festkorperelektronik

I.5 Metastable defects in hydrogen passivated n-type GaAs

C.A.B. Ball, A.B. Conibear and A.W.R. Leitch, University of Port
Elizabeth

I.6 H as a disappearing compensator, the universal panacea for
doping problems

J.A. Van Vechten, Oregon State University

I.7 Donor-hydrogen complexes and passivation in Si

Z.N. Liang and L. Niesen, Groningen University

I.8 Defects in III-V compound semiconductors studied by
perturbed angular correlation

W. Pfeiffer, M. Deicher, A. Burchard, R. Keller, T. Konig, R.
Magerle, H. Skudlik, Universitat Konstanz

I.9 Strongly polarized C-H vibrations in GaAs:C epilayers grown
by MOMBE

Y.M. Cheng, M. Stavola, D. Kozuch, S.J. Uffring, Lehigh
University

C.R. Abernathy and S.J. Pearton, AT&T Bell Laboratories

I.10 Symmetry and reorientation of the $\text{Si}_{\text{As}}\text{-H}$ complex in GaAs

D.M. Kozuch and M. Stavola, Lehigh University

S.J. Pearton and J. Lopata, AT&T Bell Laboratories